

PPT Stakeholders Meeting Mar 29, 2011 (Poster List)

Sector	#	Name	Poster Topic
AG	1	Cho, Kyungmin Jacob / University of Cincinnati	Comparison of Workplace Protection Factors for Different Aerosol Contaminants on Agricultural Farms
AG	2	Conners, Maureen / NE Center for Agricultural Health	The Impact of a Rural Based Personal Protective Equipment Program
AG	3	Palmández, Pablo / Pacific NW Agricultural Safety and Health Center, University of WA	Listening to the Experts on Personal Protective Equipment: Orchard managers, pesticide handlers, and pesticide safety educators and agriculture safety specialists on PPE barriers and solutions in the tree fruit industry
AG	4	Groce, Dennis / (FOH) Badger Technical Services	Updates to the NIOSH National Pesticide PPE Surveillance and Intervention Program
AG	5	Syamlal, Girija / NIOSH DRDS SB	Prevalence of respirator/dust mask use among U.S. primary farm operators: Analysis of the 2006 farm and ranch survey
AG	6	Richards, Kerry / Pennsylvania State University Pesticide Education Program	A Partnership for Pesticide Exposure Reduction through PPE Outreach and Education.
AG	7	Ruiz, Virginia / Farmworker Justice	Weak Label Requirements and Inadequate Protective Gear Put Workers at Risk
AG	8	Tutor, Robin / NC Agromedicine Institute	North Carolina's Response to EPA's New Risk Mitigation Measures for Soil Fumigants
HC	9	Benson, Stacey / NIOSH NPPTL	Aromatic Hydrocarbon Adsorption Characteristics of Disposable Filtering Facepiece Respirators that Contain Activated Charcoal
HC	10	Oke, Charles / NIOSH NPPTL	Development of a National Demonstration and Sentinel Surveillance System for PPE Usage by Healthcare Workers (HCWs) in the US.
HC	11	Yarbrough, Mary / Vanderbilt University	Protecting healthcare workers from an airborne respiratory event: Implementing a sentinel surveillance system to monitor PPE usage in the United States healthcare system
HC	12	Durand, Kate / California Department of Public Health	Respirator Intervention and Evaluation (REACH I&E)
HC	13	Bergman, Michael / NIOSH NPPTL	Impact of Multiple Consecutive Donnings on Filtering Facepiece Respirator Fit
HC	14	Roberge, Raymond / NIOSH NPPTL	The Impact of a Surgical Mask and Filtering Facepiece Respirators on Human Thermoregulation
HC	15	King, William / NIOSH NPPTL	Ultrasound for the Assessment of Respirator Fit
HC	16	Phalen, Robert / CSUSB	Tensile Properties and Integrity of Cleanroom and Low-modulus Nitrile Exam Glove Formulations
HC	17	Kilinc-Balci, F. Selcen / NIOSH NPPTL	Assessment of Research Gaps in Healthcare Worker PPE
HC	18	Zhuang, Ziqing / NIOSH NPPTL	Laboratory Study to Assess Causative Factors Affecting Temporal Changes in Filtering-Facepiece Respirator Fit: Part II – One Year Assessment of Fit Changes
HC	19	Szalajda, Jon / NIOSH NPPTL	Respirator and surgical mask efficacy for cough aerosols
HC	20	Que Hee, Shane S. / UCLA	Glove Permeation with a Dextrous Robot Hand System

Sector	#	Name	Poster Topic
MN	21	Hudak, Roberta / NIOSH OMSHR HLPB	NIOSH Hearing protection innovations and evaluations
MN	22	Lutz, Brent / Synkera Technologies Inc.	Advances in Chemical Sensing Allow Improvements in PPT
MN	23	Monaghan, Bill / NIOSH NPPTL	Mine Rescue Ensembles for Underground Coal Mining
MN	24	Pollard, Jonisha / NIOSH OMSHR DMRO HFB	Development of a Novel Kneepad for Mining
MN	25	Sammarco, John / NIOSH OMSHR	Light-Emitting Diode (LED) Cap Lamp Research
MN	26	Stein, Bob / NIOSH NPPTL	Long Term Field Evaluation of Respiratory Devices
PS	27	Peterson, Jeff / NIOSH NPPTL	NIOSH Respirator Certification and Approval
PS	28	Gavel, Kim / NIOSH NPPTL	Certified Product Investigation Procedures
PS	29	Lee, Joo-Young / Kyushu University, Japan	Alarm and danger criteria in foot temperature to prevent the heat stroke of workers wearing personal protective clothing
PS	30	Cloonan, Terrence / NIOSH NPPTL	CBRN Respiratory Protection Program Designs
PS	31	Cloonan, Terrence / NIOSH NPPTL	CBRN Respirator Training Concept Standard
PS	32	Palya, Frank Jr. / NIOSH NPPTL	Chemical, Biological, Radiological and Nuclear (CBRN) Combination Respirator Unit (CRU) Project
PS	33	Rajagopalan, Shyamala / NanoScale Corporation	From Nanoparticles to Novel Protective Garments
PS	34	Rehak, Tim / NIOSH NPPTL	Wildland Fire Fighting Operations Certification Standards
PS	35	Shepherd, Angie / NIOSH NPPTL	Development of a New Test Chamber with Precise Temperature and Humidity Control for Protective Clothing Chemical Permeation Testing
PS	36	Pouchot, Tom / NIOSH NPPTL	Firefighter Equipment Evaluation Program
PS	37	Srinivas, Girish / TDA Research, Inc	PPE Development at TDA Research
PS	38	Turner, Nina / NIOSH NPPTL	Firefighters' Physiological Responses to Boot Weight and Sole Flexibility during Ladder Climbing and Obstacle Crossing
PS	39	Williams, W. Jon / NIOSH NPPTL	Field Evaluation of a New Prototype Self-Contained Breathing Apparatus

Sector ID: **AG** = Agriculture / **HC** = Healthcare / **MN** = Mining / **PS** = Public Safety

PPT Stakeholders Meeting Mar 29, 2011 (Agriculture Poster Abstracts)

AG# 1: Comparison of Workplace Protection Factors for Different Aerosol Contaminants on Agricultural Farms

Authors and Organization: Kyungmin Jacob Cho, Tiina Reponen, Roy McKay, Atin Adhikari, Umesh Sigh, Alok Dwivedi, Rakesh Shukla, Susan Jones, Gordon Jones, Sergey A. Grinshpun
University of Cincinnati

Abstract

The study objective was to compare workplace protection factors (WPFs) for five different aerosol contaminants; endotoxin, fungal spores, (1->3)-beta-D-glucan, total particle mass, and total particle numbers (in the size range of 0.7-10 µm). Twenty-five farm workers wore an N95 elastomeric respirator (ER) and an N95 filtering facepiece respirator (FFR) while performing activities at eight locations representing horse farms, pig barns, and grain handling sites. For the measurement of WPFs, particles were collected on filters simultaneously inside and outside the respirator for 30 minutes during a 60-minute experiment. One field blank per subject was collected. A reporting limit (RL) was established for each contaminant based on geometric means (GMs) of the field blanks as the lowest possible measurable value. Depending on the contaminant type, 0-52 % of data points were below the RL. Therefore, a censored regression model was used to estimate WPFs. No significant difference in WPF was identified between types of respirator worn, but significant differences were found between types of contaminants. GMs of WPF for the two types of respirators combined were 153, 34, 21, 20, and 183 for endotoxin, fungal spores, (1->3)-beta-D-glucan, total particle mass, and total particle numbers, respectively. WPF were more strongly associated with concentrations measured outside the respirator for endotoxin, fungal spores, and total particle mass than for total particle numbers. The observed difference may be attributed to the difference in the sensitivity of the analytical methods to detect high WPFs at the concentration levels prevailing at tested field sites.

AG# 2: The Impact of a Rural Based Personal Protective Equipment Program.

Authors and Organization: Maureen Conners, Samantha Park, Todd Fiske, John May, Steve Clark
Northeast Center for Agricultural Health

Abstract

Agriculture is the most hazardous industry in the nation. Farmers perform chores which pose threats to their health and safety. They are repeatedly exposed to noise, chemicals, dust, mold, and the risk of physical injuries.

Although Personal Protective Equipment (PPE) has been proven to prevent injury and promote farmer's health, access can be a limiting factor for rural populations, in turn, reducing their use of the PPE. Improving availability of PPE and encouraging proper use could reduce the risk of injury and illness.

The Northeast Center for Agricultural Health (NEC) has created a PPE program that offers a variety of selected products that are affordable and appropriate for farmers. Our program features convenient access, low costs, and an inventory of continually updated merchandise. Product sales are backed by trained professionals who can answer questions and offer consultations on proper use of PPE. NEC PPE is available at a number of agricultural expositions across New York. It is also available by mail using the NEC catalogue, which is now widely available in New York and Vermont.

We conclude that: 1) farmers are interested in protecting themselves and their families; 2) promotion at farm events and direct sales are an effective way of improving availability of PPE; 3) this type of PPE program can be established for rural populations in other regions of the country.

PPT Stakeholders Meeting Mar 29, 2011 (Agriculture Poster Abstracts)

AG# 3: Listening to the Experts on Personal Protective Equipment: Orchard managers, pesticide handlers, and pesticide safety educators and agriculture safety specialists on PPE barriers and solutions in the tree fruit industry

Authors and Organization: Kit Galvin, Pablo Palmández, Jen Krenz
Pacific Northwest Agricultural Safety and Health Center, University of Washington

Abstract

The "Interventions to Minimize Agricultural Worker and Family Pesticide Exposure" project is based on the premise that pesticide handlers and orchard managers are the experts and know best about barriers to and solutions for pesticide safety, because they perform the daily work of tree fruit production. Active participation from these experts, as well as, pesticide safety educators, and agricultural safety specialists is integral to the success of this five year study designed to identify and evaluate practical pesticide safety solutions and new interventions. This poster summarizes data on PPE barriers and solutions from four sources the: Expert (key informant) Interviews at the project onset; Expert Working Group that contributed throughout the study; identification and evaluation of practical pesticide safety solutions that are 'orchard grown'; and results from a state multi-agency collaboration to identify risk factors and solutions that was part of companion PNASH research project "Risk Factors for Cholinesterase Depression among Pesticide Handlers."

PPE barriers and solutions addressed both specific issues, as well as, broader topics related to management/worker relationships, cultural issues, and workplace safety culture. Examples of PPE barriers included hot weather, not enough time to decontaminate, cultural differences, lack of respirator cartridge change out schedules, PPE interfering with work activities, and insufficient English or scientific literacy to read pesticide labels. Examples of solutions included, cooling off under an outdoor shower, decontamination stations, and PPE that is low-cost and is compatible with work tasks (e.g. gloves). (Research funded through CDC/NIOSH Cooperative Agreement #2 U50 OH07544.)

AG# 4: Updates to the NIOSH National Pesticide PPE Surveillance and Intervention Program

Authors and Organization: Kimberly Faulkner, Dennis Groce, Maryann D'Alessandro
NIOSH NPPTL

Abstract

Introduction: There are approximately 18,000 pesticide poisonings each year among U.S farm crop workers and potentially many more unquantified chronic illnesses and other adverse health effects from undue pesticide exposure. Pesticide personal protective equipment (PPE) is often a critical last line of defense against pesticide exposure, yet, there are only limited data assessing pesticide PPE use practices among farm workers.

Methods: To address these concerns, NIOSH is leading a five-year National Pesticide PPE Surveillance and Intervention Program. Program objectives include: 1) to assess the appropriateness of PPE use practices, 2) to identify barriers to best PPE practices and 3) to design, implement and evaluate interventions. Thus far, NIOSH has developed a national partnering network of approximately 700 agricultural and pesticide safety professionals, PPE and pesticide manufacturers and suppliers, pesticide handlers and growers and their advocates. NIOSH has hosted 8 national meetings with expert partners to develop the program and to identify barriers to best PPE practices.

Results: Major barriers to using the appropriate type of PPE and not wearing, storing, decontaminating or replacing, inspecting, or maintaining PPE correctly, include handler or supervisor does not know appropriate type of PPE or appropriate methods of using PPE, PPE is not accessible or provided, appropriate PPE or appropriate methods of using PPE are not accepted by handlers, and limited facilities. Based on identified barriers, a comprehensive survey of PPE use practices and barriers has been drafted and a national meeting organized to forge collaborations to overcome barriers.

Conclusions: Next steps of the NIOSH program include implementing the survey and analyzing and disseminating results. These results will be the basis for future collaborative intervention efforts to improve PPE practices and reduce pesticide illnesses associated with poor PPE practices among farm workers.

PPT Stakeholders Meeting Mar 29, 2011 (Agriculture Poster Abstracts)

AG# 5: Prevalence of respirator/dust mask use among U.S. primary farm operators: Analysis of the 2006 farm and ranch survey

Authors and Organization: G Syamlal, PL Schleiff, JM Mazurek, BC Doney, DF Greskevitch, GJ Kullman
NIOSH DRDS SB

Abstract

Objectives: To estimate national prevalence of respirator/dust mask use and to describe hazards for which respirators/dust masks are used on the farm among primary farm operators.

Methods: We analyzed the 2006 Farm and Ranch Safety Survey data collected for 12,278 actively farming primary farm operators. Weighted prevalence and prevalence odds ratios (PORs) of respirator/dust mask use were calculated using SAS® survey procedures based on the response to the question "In the last 12 months, have you/the farm operator used a respirator or dust mask on your farm or ranch?"

Results: Of the estimated 2.1 million farm operators, 37% reported respirator/dust mask use on their farm. Respirator/dust mask use prevalence was significantly higher among: males than females (39% versus 24%; POR=2.0); operators aged 16–34 years than those aged ≥65 years (47% versus 30%; POR=2.0); operators on crop farms than livestock farms (41% versus 34%; POR=1.3); operators on farms with value of sales ≥\$100,000 than operators on farms with value of sales <\$100,000 (57% versus 33%; POR=2.7). Of operators using respirators/dust masks, 70% reported respirator/dust mask use when working in dusty environments, 23% when using pesticides, and 30% for other farm-work activities. Operators were about two times more likely to have used a respirator/dust mask while doing farm activities, including welding, entering a manure pit, applying anhydrous ammonia, exposed to moldy dust, or worked with diesel tractors.

Conclusions: Prevalence of respirator/dust mask use varied significantly across population subgroups. Additional studies are needed to better understand factors associated with respirator use on farms including operators' knowledge on the proper respirator selection, use, and maintenance.

AG# 6: A Partnership for Pesticide Exposure Reduction through PPE Outreach and Education

Authors and Organization: Kerry Richards, Bill Riden, Christina Becker
Penn State Pesticide Education Program

Abstract

This poster will highlight programs illustrating the partnership between the Penn State Pesticide Education Program and the Pennsylvania Department of Agriculture Bureau of Plant Industry to promote reducing pesticide exposure through personal protective education and outreach programs. Poster highlights will include examples of:

- Hands-on lessons presented to pesticide applicators
- PowerPoint presentations used in outreach programming
- Visuals used to stress exposure potential and exposure reduction strategies
- Worker Protection Safety Training via DVDs for workers/handlers in Spanish/English for several commodities
- Poison Prevention education and outreach for consumers and youth

These materials can be adapted to meet the needs of the participants' stakeholders.

PPT Stakeholders Meeting Mar 29, 2011 (Agriculture Poster Abstracts)

AG# 7: Weak Label Requirements and Inadequate Protective Gear Put Workers at Risk

Authors and Organization: Virginia Ruiz, Farmworker Justice; Anne Katten
California Rural Legal Assistance Foundation
Jeannie Economos
Farmworker Association of Florida

Abstract

Researchers and farmworker advocates alike have identified barriers to access and proper use of appropriate personal protective equipment for farmworkers who mix, load and apply pesticides. However, even when the PPE requirements on a pesticide label are strictly followed, there are situations where required PPE is inadequate and workers are left unprotected against obvious exposures.

This poster presentation will provide examples from research, case studies and regulatory investigations that demonstrate the deficiencies of some pesticide labels regarding PPE.

For example:

- Protective footwear isn't required on many pesticide labels even though contaminated shoes are a documented source of take home exposure to pesticides as they are to other chemicals.
- Air blast applications of pesticides in orchards and vineyards often result in worker exposures because eye protection designed to prevent splash exposure doesn't protect against clouds of pesticide spray or dust, and some pesticide labels do not require respirators for air-blast applications.
- Flimsy or poorly fitting equipment provides little to no protection.

The poster will also include recommendations for reducing worker exposures through improving label directions and other means, as well as photos documenting such worker exposures.

AG# 8: North Carolina's Response to EPA's New Risk Mitigation Measures for Soil Fumigants

Authors and Organization: Robin Tutor, NC Agromedicine Institute, Bob Bruss
NC Department of Agriculture - Pesticides Section
Frank Louws
NC State University - Department of Plant Pathology
Rob Walker
NC State University - Department of Plant Pathology

Abstract

Effective 12.31.10, farms using chloropicrin, dazomet, metam sodium/potassium, and methyl bromide are required to comply with new risk mitigation measures (RMMs) from the US Environmental Protection Agency. RMMs will be phased in over two year and include requirements for worker protection. Farms are required to have up to two people per fumigation site who are medically cleared, fit tested, and trained to use respiratory protection. In order to assist more than 2200 farms across North Carolina in complying with these requirements, the NC Agromedicine Institute ('the Institute') in partnership with the NC Departments of Agriculture – Pesticides and Agronomy Divisions, NC State University – Departments of Plant Pathology and Horticulture, NC Department of Health and Human Services, NC Strawberry Growers Association, the EI Group, a private occupational health company, and representatives from the chemical industry have come together to form a Soil Fumigant Workgroup. The workgroup provides coordination for training of farmers, Cooperative Extension Agents, Pesticide Inspectors, agronomists, and agribusiness on the RMMs with the Institute taking the lead on respiratory protection training. Through a grant from the NC Tobacco Trust Fund Commission, the Institute is also working with the EI Group and other occupational health companies to provide medical clearance, respirator fit testing, respirators, and cartridges on a >50% cost share basis. Through the RMMs project, farm awareness and knowledge of selection, use, and care of respiratory protection is being significantly impacted.

PPT Stakeholders Meeting Mar 29, 2011 (Healthcare Poster Abstracts)

HC# 9: Aromatic Hydrocarbon Adsorption Characteristics of Disposable Filtering Facepiece Respirators that Contain Activated Charcoal

Authors and Organization: Stacey Benson, Tony Rozzi, Jay Snyder and Debra Novak
NIOSH NPPTL

Abstract

Disposable filtering facepiece respirators (FFRs) used by healthcare workers (HCWs) are not designed to reduce the inhalation of volatile organic compounds (VOCs). Smoke generating surgical procedures release VOCs and have been associated with the following complaints: foul smell, headaches, nausea, irritated throat and lungs, and asthma. Industrial workers sometimes use nuisance organic vapor FFRs that contain activated charcoal. These respirators provide odor control to increase worker comfort, but are not marketed as respirators that provide respiratory protection against a gas or vapor. The objective of this study was to investigate the aromatic hydrocarbon adsorption characteristics of nuisance organic vapor FFRs.

Three FFR models were tested to determine the 10% breakthrough time for three aromatic hydrocarbons. All respirator models were exposed to each vapor separately (20 ppm, 37 LPM) in three duplicate tests (n=27). Periodically, gas samples were directed to an SRI Gas Chromatograph (Model 8610C) for analysis. The experimental results were then used to predict breakthrough curves for various challenge concentrations. The 10% breakthrough values were over 66 minutes, 96 minutes and 111 minutes for benzene, toluene and xylene respectively. The predicted breakthrough curves matched the experimental data. The respirators were tested with challenge concentrations at 20 ppm and did not exceed 10% breakthrough values for at least 66 minutes. The goal of Project BREATHE (Better Respiratory Equipment utilizing Advanced Technologies for Healthcare Employees) is to advance technologies for the next generation of HCW respirators. Exploring the adsorption capability for thin carbon layers may be advantageous to this endeavor.

HC# 10: Development of a National Demonstration and Sentinel Surveillance System for PPE Usage by Healthcare Workers (HCWs) in the US.

Authors and Organization: CA Oke, D Novak et al.
NIOSH NPPTL
M Yarbrough, M Bruer
Vanderbilt University

Abstract

PURPOSE: To establish a national ongoing, continuous PPE usage surveillance system for HCWs in the US. The IOM committee on PPE submitted in 2007 that during Pandemic Influenza, HCWs will feel more secure only when PPE usage is as safe and effective as vaccines and medications. The expected outcomes are to enhance timely interventional response during disasters such as Pandemic Influenza from hospital to hospital, PPE policies and standard of operating procedures (SOPs) for first receivers and responders nationwide.

METHODS: Monitor the PPE (e.g. respirator) selection, use, fit, supplies, defects, audits, recalls, and effectiveness in each of the selected facilities among HCWs; especially workers with direct patient care. Conduct a daily and ongoing active and passive surveillance using a standardized electronic format and questionnaire. When an incident of interest (IOI) occurs, e.g. lapses or disease transmission, investigation is initiated by the project officer.

RESULTS: The expected outputs are to describe/document the evaluation and monitoring of PPE selection, usage, non-usage, defects, fitting and effectiveness of respirators in the hospital environment. Secondly, to develop a functioning model that ensures hospitals are better prepared for Pandemic Influenza and other disasters (natural and man-made). Thirdly, to disseminate the findings in professional journals and present at appropriate conferences.

CONCLUSION: The value of monitoring and evaluating the activities and resources regarding PPE use among HCWs and safety prevention programs in major hospital systems will be formally assessed.

PPT Stakeholders Meeting Mar 29, 2011 (Healthcare Poster Abstracts)

HC# 11: Protecting healthcare workers from an airborne respiratory event: Implementing a sentinel surveillance system to monitor PPE usage in the United States healthcare system

Authors and Organization: Mary Yarbrough, Michele Bruer, Paula McGown, Melanie Swift
Vanderbilt University
Debra Novak, Charles Oke
NIOSH NPPTL

Abstract

Vanderbilt's Faculty and Staff Health and Wellness Department is collaborating with the National Institute for Occupational Safety and Health (NIOSH) to study the implementation of a sentinel surveillance system for ongoing and continuous monitoring of Personal Protective Equipment (PPE) usage by U.S. healthcare workers. The goal is to identify, describe and evaluate the surveillance systems currently in place at Vanderbilt's medical center that are used to protect healthcare workers from airborne infectious disease. This data can be used by NIOSH to build a national sentinel surveillance system of PPE used by U.S. healthcare workers, allowing them to 1) track activities, resources and outcomes related to PPE usage in an airborne respiratory event, 2) answer research questions of efficacy, comfort and safety for different kinds of masks used by healthcare workers and 3) advise hospitals, researchers and government agencies with research supported recommendations related to PPE practices.

HC# 12: Respirator Intervention and Evaluation

Authors and Organization: Kate Durand, Barbara Materna
California Department of Public Health
Debbie Novak
NIOSH NPPTL

Abstract

Some state health departments have the responsibility for the surveillance and investigation of work-related injuries and diseases in their respective states. Since the outbreak of H1N1 in spring 2009, the California Department of Public Health has been working to examine and clearly understand the risks of H1N1 exposure and make appropriate recommendations about respiratory protection in the healthcare setting. They are currently monitoring the implementation of aerosol transmittable diseases (ATD) and respiratory protection programs among hospitals in their respective counties. Preliminary findings suggest that N95 respirators are being widely used, although gaps in training, appropriate will expand and build upon the work previously completed under REACH I by examining the effectiveness of various interventions in improving respiratory protection programs in acute care facilities.

HC# 13: Impact of Multiple Consecutive Donnings on Filtering Facepiece Respirator Fit

Authors and Organization: Michael S. Bergman, Dennis J. Viscusi, Ziqing Zhuang, Andrew J. Palmiero, Jeffrey B. Powell, Ronald E. Shaffer
NIOSH NPPTL

Abstract

The objective of this study was to assess the impact of multiple donnings on the fit of NIOSH-certified N95 filtering facepiece respirators (FFRs). Six FFR models were each tested by a group of 10 experienced subjects using the TSI PORTACOUNT® Plus and N95 Companion™. Each subject performed up to 20 consecutive fit tests on an individual FFR sample using an abbreviated fit test protocol. A fit test resulting in a fit factor ≥ 100 was deemed "passing". Consecutive fit testing was terminated in the event of three consecutive fit test failures (fit factor ≤ 100) or a head strap break; these failures along with nosepiece breaks were used to calculate cumulative failure rates.

Mean fit test 'Passing Rates' were compared for the first group of five donnings to each subsequent group of five donnings resulting in statistically significant reductions for donnings #11-15 for three models and for donnings #16-20 for all six models. Cumulative failure rate data suggest that five consecutive donnings can be performed before significant failures were observed. However, even after 20 donnings, 55-65% of fit tests resulted in passing results and 30-65% of fit tests achieved a fit factor of 200 (the upper limit of the instrument) indicating that good levels of fit are achievable for some test subject / FFR model combinations. Results indicate that multiple donnings have a model dependent impact on fit. Further research is necessary to better understand how multiple donnings affect FFR fit in the workplace.

PPT Stakeholders Meeting Mar 29, 2011 (Healthcare Poster Abstracts)

HC# 14: The Impact of a Surgical Mask and Filtering Facepiece Respirators on Human Thermoregulation

Authors and Organization: Raymond J. Roberge, Stacey M. Benson, Jeffrey B. Powell, Ronald Shaffer
NIOSH NPPTL

Abstract

Comfort and tolerance are major factors impacting the appropriate use of protective facemasks such as filtering facepiece respirators and surgical masks; that is, discomfort leads to intolerance and intolerance leads to noncompliance. One of the most commonly-reported complaints is that of increased face and body heat. The airway is responsible for elimination of 8% - 15% of body heat, and the use of facemasks limits the expulsion of heat carried on exhaled air to the outside environment, as well as preventing evaporative heat loss from the covered portion of the face. The current NPPTL study is using wireless sensor technology to determine core, facial and respirator deadspace temperatures and humidity associated with the use of protective facemasks to determine the true impact on human thermoregulation. Comparisons are also being made between objectively-obtained physiological measurements and concurrently-administered standardized comfort and exertion scores to ascertain the degree of overlap, if any, of subjective and objective responses to the use of protective facemasks over one and two hour exercise periods. Preliminary data from the study will be reported.

HC# 15: Ultrasound for the Assessment of Respirator Fit

Authors and Organization: William P. King, and J. V. Szalajda
NIOSH NPPTL

Abstract

Respirator fit information obtained during use would aid in improving efficacy. No widely applicable methods exist for monitoring fit while working in a respirator.

Fluid leak detection is widely addressed by detecting ultrasound (cyclic sound pressure ≥ 20 kilohertz) that is either generated by turbulent leak flow or admitted via the leak path from a source. Leak flow in half-mask respirators appears not to be generally turbulent and hence, not expected to produce ultrasound. However, flow in nasal breathing is turbulent, producing detectable ultrasound.

Using nasal breathing as source, the intensity of ultrasound measured through leaks showed a good correlation with diameter for both exhalation and inhalation. To assess the relationship between half-mask respirator fit and ultrasound leakage experiments were conducted using the wearer's nasal breathing as ultrasound source. Probed respirators were used to simultaneously measure fit factor. During the fit factor sampling (one minute) the wearer breathed through nose and the ultrasound levels outside around the respirator face seal were measured. Each respirator was measured several times using different head strap tensions to vary fit. The average peak ultrasound correlated well with measured fit factor. Results with single tests of several N95 filtering facepiece respirators also gave a good correlation.

These results together with the salient aspects of ultrasound technology indicate the potential to measure practically the status of respirator fit in situ using ultrasound.

PPT Stakeholders Meeting Mar 29, 2011 (Healthcare Poster Abstracts)

HC# 16: Tensile Properties and Integrity of Cleanroom and Low-modulus Nitrile Exam Glove Formulations

Authors and Organization: Robert N. Phalen
CSUSB
Weng Kee Wong
UCLA

Abstract

Millions of workers are exposed to chemical and biological hazards in the workplace each year. Disposable nitrile gloves are a common choice as a barrier to these hazards; however, glove selection is complicated by the availability of several types or formulations. This study evaluated the tensile properties and physical integrity (i.e. leak failure rates) of two different nitrile exam glove types: 1) cleanroom gloves; and 2) low-modulus gloves. The primary aims were to determine if the two glove types were different in tensile properties and integrity, and if tensile properties were associated with integrity. Six cleanroom and five low-modulus nitrile exam glove products were evaluated. Tensile testing was conducted using the American Society of Testing and Materials Method D 412. A modified water-leak test was used to detect small holes capable of passing a virus. On average, significant differences in the tensile strength and modulus 50-100% existed between the two glove types ($p < 0.05$). Modulus 50-100% was the strongest indicator of glove type between the two formulations. On average, the leak failure rates were significantly different ($p < 0.05$) between the two glove types. The cleanroom gloves were about three times more likely to have leak failures than the low-modulus gloves. From an infection control standpoint, the low-modulus gloves appear to be a better choice for protection. However, the observed variability between glove products and brands indicate that glove selection cannot rely solely on glove type.

HC# 17: Assessment of Research Gaps in Healthcare Worker PPE

Authors and Organization: F. Selcen Kilinc
NIOSH NPPTL

Abstract

Personal protective equipment (PPE) is a critical component in the hierarchy of controls used to protect healthcare personnel from infectious hazards. Healthcare worker PPE may include gowns, respirators, face masks, gloves, eye protection, face shields, and head and shoe coverings. Important research has been conducted in certain areas, such as respirators and masks, but studies in other areas, particularly gowns, drapes, and gloves are scarce. Understanding the issues related to the design and development of gowns and drapes, as well as the factors that impact their use, such as barrier effectiveness, comfort, cost, durability, testing, standards, maintenance, care, and awareness, are critical to ensuring healthcare personnel are adequately protected. The goal of this effort is to better understand research gaps in healthcare worker PPE to determine the focus of future NPPTL research. This poster will provide a summary of findings to date based on literature surveys, stakeholder feedback, and industry needs.

PPT Stakeholders Meeting Mar 29, 2011 (Healthcare Poster Abstracts)

HC# 18: Laboratory Study to Assess Causative Factors Affecting Temporal Changes in Filtering-Facepiece Respirator Fit: Part II – One Year Assessment of Fit Changes

Authors and Organization: Ziqing Zhuang, Andy Palmiero, Stacey Benson, Michael Bergman, Raymond Roberge and Jessica Williams
NIOSH NPPTL

Abstract

The first year of a three year study to assess changes in respirator fit and facial dimensions as a function of time to improve the scientific basis for the periodicity of fit testing has been completed. A representative sample of 229 subjects was initially enrolled in the study with 199 continuing to participate. On each visit, subjects performed three fit tests each on three different respirator samples from the same model for a total of nine fit tests. Inward leakage and filter penetration were measured for each donned respirator, permitting the calculation of face seal leakage (FSL). At each visit, 3-D scans of subjects were captured and height, weight and 13 traditional anthropometric facial dimensions measured.

The mean FSL for Visit 1 was 0.69% (SD=0.36) with a range of 0.11% to 2.13%. The mean change in FSL between Visits 1 (baseline) and 2 (six months later) was 0.36% (SD=1.39), and between Visits 1 and 3 (one year later) was 0.25% (SD=0.82). For Visit 2, 8.4% of the subjects had unacceptable fit (90th percentile FSL > 0.05%). For Visit 3, 10.3% of the subjects had unacceptable fit. These preliminary results suggest that many subjects experienced a significant change in fit during the first year. Anthropometric data and 3-D scans of subjects for these first three visits are still being analyzed. Data collection for year 2 has begun.

HC# 19: Respirator and surgical mask efficacy for cough aerosols

Authors and Organization: Jonathan V. Szalajda, William P. King
NIOSH NPPTL
William G. Lindsley
NIOSH HELD

Abstract

Background: Few studies have been done to quantify the incremental impact of personal protective equipment (PPE) such as N95 filtering facepiece respirators (FFR) and surgical masks on aerosol transmission of viruses like influenza. During a pandemic, healthcare workers and the general public will have increased reliance on PPE for personal protection. Controlled studies are needed to assess the efficacy of surgical mask and FFR use in preventing airborne disease transmission.

In healthcare settings during periods of respiratory infection activity, CDC recommends that surgical masks be offered to patients who have respiratory infection symptoms. CDC also recommends that a surgical mask be worn by healthcare personnel in close contact (within 3 feet) of patients with symptoms of respiratory infection and that healthcare workers protect themselves from diseases spread through airborne transmission by wearing a fit-tested respirator. WHO recommends masks be worn where airborne infection is possible.

Methods: This project measures how well surgical masks and disposable FFR protect healthcare workers from aerosols produced by a coughing patient. The test system is contained in a room-sized environmental chamber and has 3 main parts: (1) a simulator that discharges an aerosol-laden cough through a mannequin head form (called the coughing head form); (2) a second mannequin head form (called the breathing head form) that is connected to a breathing machine to simulate respiration and that can be fitted with PPE; and (3) aerosol particle counters that measure the particle concentrations in the coughing and breathing systems and at different locations throughout the room. The efficacy of surgical masks and respirators versus no mask is being evaluated along with the influence of parameters including protection factor, breathing rate, relative position, and cough frequency.

Results: Preliminary results show that the aerosol exposure is highest with no PPE, followed by surgical masks, and the least exposure seen with N95 FFR. With N95 FFR the magnitude of exposure also depended on the protection factor. These differences are seen regardless of breathing rate and the relative position of the head forms.

Conclusions: Study results provide a better understanding of the efficacy of surgical masks and FFR when exposed to aerosols generated by a cough, and enable NIOSH to provide research-based recommendations for effective respiratory protection strategies in healthcare settings.

PPT Stakeholders Meeting Mar 29, 2011 (Healthcare Poster Abstracts)

HC# 20: Glove Permeation with a Dexterous Robot Hand System

Authors and Organization: Shane S. Que Hee, Airek R. Mathews, and Jose Zavala
University of California, Los Angeles

Abstract

The aims were to assess how glove normalized breakthrough time, steady state permeation rate, and diffusion coefficient of a dexterous robot hand whole glove model exposed to moderately nonvolatile solvents compared with the parameters of the closed loop ASTM type method, and to create a mathematical model linking the two. The glove type selected was disposable nitrile. A chemical suite was evaluated for glove degradation (discoloration; irreversible swelling/shrinking; reversible swelling/shrinking; and no apparent effect). The chemicals (boiling points) were: amyl acetate (148), aniline (184), benzaldehyde (179), benzotrichloride (213), benzyl alcohol (secondary reference, 206), benzyl chloride (179), butylcarbitol (231), butylcellosolve (170), butyrolactam (245), cellosolve acetate (156), chloronaphthalene (250), 2-chlorophenol (176), 2-chlorotoluene (159), 3-chlorotoluene (161), 4-chlorotoluene (164), cyclohexanol (161), cyclohexanone (157), 1,5-cyclooctadiene (151), diacetone alcohol (167), dibutylphthalate (340), dimethylacetamide (166), dimethylformamide (secondary reference, 152), ethylene glycol (198), ethyl glycollether (170), furfural (162), 1-heptanol (176), methyl amylketone (150), nitrobenzene (211), octanol (195), oleic acid (360), styrene (145), tricresyl phosphate (420), and triethanolamine (360). Of these only 2-chlorophenol, cyclohexanol, diacetone alcohol, ethylene glycol, octanol, tricresyl phosphate, and triethanolamine showed no effect. Closed loop 8-hour permeation studies in ASTM type cells with water as collection solvent showed that ethylene glycol and triethanolamine did not permeate enough. Cyclohexanol had a normalized permeation time within one hour (experiments still ongoing), a steady state permeation rate of 2.01 to 7.59 g cm⁻² h⁻¹ (arithmetic mean and standard deviation 5.7 ± 1.3), and a lag time of 96.2 to 110.5 min (arithmetic mean and standard deviation 108. ± 11).

PPT Stakeholders Meeting Mar 29, 2011 (Mining Poster Abstracts)

MN# 21: NIOSH Hearing protection innovations and evaluations

Authors and Organization: Roberta Hudak and Jessie Mechling
NIOSH OMSHR HLPB

Abstract

Miners and other workers need to rely on hearing protection whenever their noise exposure reaches hazardous levels that can't be sufficiently reduced through noise controls. This poster presentation will demonstrate several new hearing protection-related innovations from the NIOSH mining hearing loss research program. The program has investigated the benefits of sound restoration hearing protectors when used to address audibility issues in noisy mining environments. Although the devices did not significantly reduce the masking effects of background noise in our studies, they still have practical benefits for intermittent noise situations. The research program's QuickFit device that provides a simple fit check for earplugs will also be demonstrated. Finally, a new version 3.0 of the NIOSH Hearing Loss Simulator will also be described. The Simulator gives an audible and visual demonstration of the effects of a noise-induced hearing loss. The new version adds the capability to process user-provided mp3 files, a display that depicts foreground and background sounds, and several other user-suggested improvements. Finally, the poster will also describe the latest communication materials that provide simple explanations of the value of regular hearing tests and the hierarchy of effective noise controls.

PPT Stakeholders Meeting Mar 29, 2011 (Mining Poster Abstracts)

MN# 22: Advances in Chemical Sensing Allow Improvements in PPT

Authors and Organization: Brent Lutz and Debra Deininger
Synkera Technologies Inc.

Abstract

Synkera has developed a line of ultra-small and lightweight yet high performing chemical sensors. These sensors will allow advances in the functionality of PPT, leading to enhancements in worker health and safety.

One example of the implementation of Synkera sensors for improvements in PPT is active ESLI in respirators. A second example is the demonstration of single gas detection in a Smart Gas Card format. A third example is the improved reliability of detection through the use of multiple complementary sensor technologies.

This poster describes the form and function of the Synkera sensors and offer examples of integration with PPT.

MN# 23: Mine Rescue Ensembles for Underground Coal Mining

Authors and Organization: William D. Monaghan, F. Selcen Kilinc-Balci, Angie M. Shepherd, Jeffrey B. Powell, Nina L. Turner, Raymond J. Roberge
NIOSH NPPTL

Abstract

Mine rescue operations are a high risk activity in underground coal mining. Mine rescue team members must be prepared to respond when an emergency occurs and take the necessary precautions required to ensure worker safety. It is vital that members of the teams have the capability and proper protection to immediately respond to a wide range of hazardous situations. Their ensembles need to protect them from hazards that they may encounter. In addition, mine rescue team members must know the limitations of their personal protective ensembles. Currently no standards exist to define the minimum protection of the protective clothing worn by these rescuers. NPPTL has undertaken a research project to determine the minimum design and performance requirements necessary for the ensembles worn by mine rescue teams. The ultimate goal of this project is to protect mine rescuers from hazards that they may face.

MN# 24: Development of a Novel Kneepad for Mining

Authors and Organization: Jonisha Pollard, Susan Moore, William Porter, Sean Gallagher Alan Mayton
NIOSH OMSHR

Abstract

An analysis of the 2007 Mine Safety and Health Administration (MSHA) injury database indicated that 84 injuries of the knee were reported for seam heights of 30"-54". In an analysis of musculoskeletal injury data from eight low-seam coal mines, Gallagher et al., 2009 reported that the mean cost for knee injuries was \$13,121.29. Considering the 84 injuries that occurred in low- and mid-seam mines, it can be estimated that these injuries cost more than \$1,000,000 in 2007. NIOSH researchers have conducted research that provides a detailed understanding of the forces and stresses at the knee when assuming postures associated with low-seam mining. A novel kneepad is currently being designed that can reduce these forces and stresses at the knee, withstand the harsh mining environment, and be accepted by the mine worker community. Within the next year, focus groups and usability testing with mine workers will be conducted as the novel kneepad is developed. Ultimately, this novel kneepad will be field and laboratory tested to demonstrate its improved function over that which is currently available in the industry.

PPT Stakeholders Meeting Mar 29, 2011 (Mining Poster Abstracts)

MN# 25: Light-emitting diode (LED) cap lamp research

Authors and Organization: John J Sammarco
NIOSH OMSHR

Abstract

Illumination plays a critical role in an underground coal and metal/nonmetal mines because miners depend most heavily on visual cues to detect potential hazards associated with roof falls, slips/trips/falls (STFs), and pinning/striking hazards involving moving machinery. It is difficult for miners to detect hazards because of the low illumination levels and the hazards are typically of very low contrast and reflectivity. There are additional challenges for older workers given that visual performance degrades as a person ages. This is an important factor given an aging U.S. coal mining workforce that averages about 43 yrs. The NIOSH mine illumination research has focused on the miner cap lamp that is often a miner's most important source of light. NIOSH researchers developed a light-emitting diode (LED) cap lamp that provides better illumination of mine hazards compared to other LED cap lamps. NIOSH conducted a study using human subjects to determine visual performance for the detection of moving machinery hazards and STF hazards. The results indicate significant improvements compared to other commercially-available LED cap lamps. For the NIOSH LED cap lamp, the ability to detect moving machinery improved 72%; and STF hazard detection improved 194%.

MN# 26: Long Term Field Evaluation of Respiratory Devices

Authors and Organization: Robert Stein
NIOSH NPPTL

Abstract

This project evaluates the best strategies for assessing the long term reliability of general industry respirators under conditions of storage as actually implemented by users. The thrust of this project is to continue the existing long-term field evaluation concept currently applied to self-contained-self-rescuers (SCSR) used in mining to respirators used in general industry and extend this approach to other types of respirators. Current standards and test methods are effective in identifying respirator designs and materials capable of providing the needed protection. The project has been designed to collect the data needed to assure that these same designs and materials are effective after being stored in workplace locations for time periods typical of those needed to maintain coverage and assure that their full level of protection will be provided when needed. This is an ongoing project that repeats in cycles. Initial efforts focus on developing a sampling program for obtaining from end users' field storage conditions in an NPPTL controlled environment. We also evaluate the appropriate test procedures to establish comparative performance between new and stored units and the appropriate periodicity for testing.

NIOSH currently also has approvals for several CBRN escape respirators and over 160 general industry escape respirators. Frequently these escape respirators are sold in sealed packages that cannot be opened prior to actual use and preclude any pre-use functional testing. Many of these devices employ mouthbit or hood user interfaces to reduce the need for sizing and fit testing. General requirements for these respirators are found in 42 CFR Part 84. 42 CFR 84.63 authorizes NIOSH to require "any additional requirements deemed necessary to establish the quality, effectiveness and safety of any respirator..." NIOSH plans to expand the existing program and will first examine the feasibility of obtaining CBRN field samples through voluntary submissions and replacement of the field-stored units in kind. Other methods may be needed such as purchase and accelerated storage life conditions. Each of these will be interim products of the project provided on a cyclical basis.

PPT Stakeholders Meeting Mar 29, 2011 (Public Safety Poster Abstracts)

PS# 27: NIOSH Respirator Certification and Approval

Authors and Organization: Jeff Peterson
NIOSH NPPTL

Abstract

The respirator certification activity is defined by regulation, 42 CFR Part 84. Millions of workers including fire fighters, construction workers, agriculture workers, miner, health care, and general industry workers rely upon respirators for protection against inhalation induced disease and injury. OSHA requires that respirators used in the workplace be certified by NIOSH to insure functionality and reliability. The Respirator Certification Program provides assurance that respirators certified by NIOSH meet defined minimum performance standards and through the audit programs, continue to be manufactured and perform in a manner that will meet or exceed the expectations for the class of respirator. This project coordinates and provides leadership to five primary functions: respirator certification; quality assurance; investigation of complaints concerning certified respirators, technical assistance, and standards development. Additionally, this project also develops the processes needed to provide certification of respiratory protection in a manner to address contemporary hazards by expeditiously incorporating technological advancements into Federal Standards. Over five million American workers including fire fighters, construction workers, agriculture workers, miners, health care and general industry workers depend upon NIOSH certified respirators for protection against airborne respiratory hazards.

PS# 28: Certified Product Investigation Procedures

Authors and Organization: Kim Gavel
NIOSH NPPTL

Abstract

Millions of workers in industry, mining, fire fighting, and emergency response rely on respirators for protection against inhalation induced disease and injury. Occupational Safety and Health Administration (OSHA), Mine Safety and Health Administration (MSHA), and other Federal Regulations require the use of NIOSH-approved respirators for worker protection against respiratory hazards. Monitoring the required quality and performance characteristics of approved respiratory products is achieved through manufacturer site audits, product audits and field investigations. The results of these activities are used by OSHA, MSHA, and other enforcement agencies to ensure that the respirators being used are providing a level of protection that meets or exceeds the performance criteria listed in 42 CFR 84. By ensuring the performance of respirators through the reduction or elimination of nonconformances, the health and safety of American workers will be improved.

The goal of this project is to increase the quality of respiratory protective devices used in the field by investigating and resolving reports of product nonconformances in a timely manner. All reports of nonconforming respirators will be investigated and the corrective actions taken by the approval holders will be reviewed and evaluated to determine if conformance to the standard is maintained. The project serves to ensure that once a respiratory protective device is approved by NIOSH, field deployed units will continue to provide respiratory protection to the user at a level that meets or exceeds the performance requirements found in federal regulations. Increasing the quality of respiratory protective devices used in the field by investigating and resolving reports of product nonconformance in a timely manner. This project ensures that approved respiratory devices continue to provide protection to users at a level that meets or exceeds the performance requirements found in the Code of Federal Regulations.

PPT Stakeholders Meeting Mar 29, 2011 (Public Safety Poster Abstracts)

PS# 29: Alarm and danger criteria in foot temperature to prevent the heat stroke of workers wearing personal protective clothing

Authors and Organization: Joo-Young Lee, Kouhei Nakao, Ilham Bakri, Yutaka Tochihara
Kyushu University, Japan

Abstract

The purpose of the present study was to set the alarm and danger criteria using foot temperature of workers wearing personal protective clothing in hot environments. Two series of experimental protocols were undertaken: Series A (a total of twelve conditions = activities (rest and exercise) × clothing (Control, Tyvek and Vinyl coveralls) × air temperatures of 25 and 32°C) and Series B (a total of eight conditions = one activity (exercise) × four types of Self-contained breathing apparatus (SCBA) with firefighters full protective clothing (Control, SCBA type A, type B and type C) × air temperatures of 22 and 32°C). The alarm and danger criteria were elicited from Series A and the criteria were then validated through Series B. The results showed that 1) foot temperatures of 37.5°C and 38.5°C were derived as alarm and danger criteria, respectively, for workers wearing full protective clothing from Series A; 2) for Control, foot temperature did not reach the alarm criterion, but for Tyvek and Vinyl conditions, the alarm criterion was obtained at the point of that foot temperature reached rectal temperature; 3) the foot temperatures of 37.5°C and 38.5°C were valid as the alarm and danger criteria, respectively, when applying to the data set of rectal temperature, energy metabolism, total sweat rate, heat storage, and subjective sensations from Series B.

PS# 30: Chemical, Biological, Radiological and Nuclear (CBRN) Respiratory Protection Program Designs

Authors and Organization: Terrence K. Cloonan
NIOSH NPPTL

Abstract

Public sector workers consisting of fire service, law enforcement, and select emergency medical services personnel are exempt from the provisions of the Occupational Safety and Health Act of 1970. These workers do not always have formal written respiratory protection programs (RPP) designed to provide standardized administrative, engineering, and protective equipment control measures specific to their workplace needs. For these responders, the onus for their respiratory protection falls to the lowest level of municipal government authority, unless covered under an existing state or commonwealth occupational safety and health plan. Consequently, public sector programs, designed to protect responders from toxic and nuisance airborne hazards vary in style, content, form of implementation, and intended use of respirators and supporting personal protective technologies (PPT). Common designs and models of RPP are needed by type of public safety sector worker class because each responder agency has common human factor requirements but different mission specific needs regarding the use of respiratory protection and supporting PPT. Programs designed to provide an administrative structure and technical guidance to responders require vetted designs and models tailored to public safety departments while incorporating precedence setting OSHA 29 CFR Part 1910.134 requirements. New RPP design and outline tools may allow existing and partial programs at the public sector level to be updated and improved in support of protecting responders tasked to work in terrorism and vigilante chemical, biological, radiological, and nuclear (CBRN) attack zones or natural disaster all-hazard environments.

PPT Stakeholders Meeting Mar 29, 2011 (Public Safety Poster Abstracts)

PS# 31: CBRN Respirator Training Concept Standard

Authors and Organization: Terrence K. Cloonan
NIOSH NPPTL

Abstract

Since December 28, 2001, public safety purchase and procurement of emergency responder personal protective equipment (PPE) designed to protect emergency response workers against a known or unknown respiratory or dermal hazard has relied on chemical, biological, radiological, and nuclear (CBRN) technical performance standards that evaluate a given item of PPE under CBRN laboratory and human factors conditions. A certificate of approval validates that technology to a specified pass/fail criteria published in a given standard. Translating those technical performance standards, criteria, and approvals into viable use applications in the field, with supporting training standards, are areas not always addressed in respirator user instructions, purchaser bid specifications, or existing responder credentialing programs. Now that the CBRN PPE is available to emergency response workers, is that equipment being maintained by trained or untrained workers? How is that equipment being trained with and to what common standard? And how are those workers being trained, assessed, credentialed, and revalidated over time to a given national, state, or local standard/professional qualification criteria? Due diligence shows that several federal agencies recognize the need to standardize emergency responder training, but only to an agency specific standard and not to a known joint federal national standard. The DOT and the Red Cross are two lead agencies that actively require emergency workers to meet agency specific training standards before the worker is deemed qualified to perform specific workplace duties, however the integration of how to use PPE, like a NIOSH-approved CBRN respirator, are rarely addressed. Economic drivers impact the level of training readiness for these workers. On December 6, 2006, the U.S. House of Representatives approved a congressional request to increase funding and improve safety training standards for the nation's 270,000 first responders, fire fighters, and emergency medical personnel. An extra \$4 million a year in funding for the federal emergency response grant program was included in H.R. 5782, the Pipeline Safety Improvement Act. The IAFF supported this resolution and praised the congressional efforts to "provide adequate funding to ensure that all emergency responders are trained" and "ensure that responders are trained to contain any release from a safe distance, keep it from spreading, and prevent people, property, and the environment from harmful exposures." Exact duties a certified first responder or follow-on emergency responder would be tasked to do in mitigating a singular or multiple CBRN attack on a municipality. However, training to a specified standard was not indicated in the language. Standardizing user instructions for NIOSH-approved CBRN respirators can be a starting point. The need to standardize user instructions format, information, and applicability for common use of CBRN respirators and accessories is a necessary step toward creating a national training baseline standard for use by any respirator manufacturer, purchaser, user, or CBRN respiratory protection program administrator. Without a common national CBRN Respirator training standard, responders will continue to approach new PPE training from strictly the manufacturer's perspective without a federal baseline of common tasks, common time donning standards, and common use, reuse, and disposal best practices.

PS# 32: Chemical, Biological, Radiological and Nuclear (CBRN) Combination Respirator Unit (CRU) Project

Authors and Organization: Frank Palya Jr
NIOSH NPPTL

Abstract

The National Institute for Occupational Safety and Health (NIOSH) is working to develop appropriate standards and test procedures for the various types of respiratory protective devices used to provide protection to workers and first responders in hazardous environments.

This project focuses on the development of an appropriate performance standard for the combination respirator unit (CRU) that will provide wearers respiratory protection against Chemical, Biological, Radiological and Nuclear (CBRN) hazards resulting from acts of terrorism.

The CRU is a multifunctional unit that employs the technology of two or more different types of respiratory protective devices. The CRU standard may include performance requirements of other types of respirators such as the Open Circuit-Self Contained Breathing Apparatus (SCBA), Closed Circuit-SCBA, Air Purifying Respirator and the Powered Air Purifying Respirator described in 42 CFR 84.

NIOSH-NPPTL intends to develop a new performance standard for the CBRN CRU and use the Rulemaking Process to promulgate the standard into 42 CFR 84. NIOSH Docket 82A has been established for the CBRN CRU project.

PPT Stakeholders Meeting Mar 29, 2011 (Public Safety Poster Abstracts)

PS# 33: From Nanoparticles to Novel Protective Garments

Authors and Organization: Dennis Karote, Jane Langemeier, Cherry Leaym, Shuvo Alam, Shyamala Rajagopalan
NanoScale Corporation

Abstract

Integration of high surface area nanocrystalline metal oxides with lightweight fabric layers has yielded reactive liner inserts for protective garments. A series of mixed metal oxides were formulated and tested for their ability to destructively absorb various toxic industrial chemicals (TICs) and chemical warfare agent (CWA) simulants. In addition to chemical reactivity, other properties such as granule size and hardness were optimized for the down selected formulation. Generally, the granulated sorbent was embedded between layers of non woven fabric to produce the desired reactive liners. Issues related to laminate weight and shedding of granules were addressed and resolved during the first stage of fabric lamination experiments. Comfort and chemical destruction properties were further refined during the second stage lamination efforts. Overall, the liner was optimized for: moisture vapor transfer, air permeability, chemical decontamination property, and added weight. FTIR and GC-MS analyses of the exposed sorbent and swatch material confirmed the degradation of CWA simulants to less toxic by-products. Longer yardage of the down selected fabric swatch was produced in a factory setting. As a proof-of-concept, a military jacket insert liner prototype was sewn from the manufactured liner. The reactive liner included protective clothing will shield environmental cleanup personnel, farm workers, HAZMAT, and others from intentionally or accidentally released threats. This investigation is well in line with NIOSH mission as the study outcome helps assure safe and healthful working conditions for anyone coming in contact with hazardous materials.

PS# 34: Wildland Fire Fighting Operations Certification Standards

Authors and Organization: Tim Rehak
NIOSH NPPTL

Abstract

Wildland fire fighters are exposed to smoke and fire gases of varying concentrations in an outdoor environment. Health concerns associated with fighting wildland fires include irritation from smoke exposure, carbon monoxide effects, and acute toxic effects of short term high exposure events resulting from rapid changes in fire conditions.

Wildland fire fighters are exposed to smoke and fire gases of varying concentrations in an outdoor environment. Health concerns associated with fighting wildland fires include irritation from smoke exposure, carbon monoxide effects, and acute toxic effects of short term high exposure events resulting from rapid changes in fire conditions.

Wildland fire fighters are exposed to fluctuating concentrations of airborne toxics from smoke and fire gases. The outdoor environment provides ventilation that is dependent on wind speed and direction relative to the location of the fire. Under ideal conditions, wildland fire fighters are exposed to low concentrations of smoke particulates and toxic fire gases. Changing conditions at the fire scene can result in short term high exposures to carbon dioxide, carbon monoxide, nitrogen oxides, sulfur dioxide, benzene, aldehydes (eg. formaldehyde, acrolein), free radicals, and respirable particulate matter.

Wildland fire fighters currently use devices that are not approved by NIOSH, various respirators that are NIOSH-approved filtering facepiece respirators, or no respiratory protection at all. Many unapproved devices masquerading as respirators do not provide adequate protection or any protection. Filtering facepiece respirators approved under the current NIOSH standards do not provide any protection against fire gases and may fail at the temperatures encountered in wildland fire fighting environments.

The National Fire Protection Association (NFPA) Technical Committee on Respiratory Protection Equipment with the support of NIOSH/NPPTL has developed a new standard for wildland fire fighter respiratory protection. Expedite development of a new wildland fire fighting respirator standard is needed to reduce the serious potential health risks to wildland fire fighters.

PPT Stakeholders Meeting Mar 29, 2011 (Public Safety Poster Abstracts)

PS# 35: Development of a New Test Chamber with Precise Temperature and Humidity Control for Protective Clothing Chemical Permeation Testing

Authors and Organization: Chris McKeel, Matt Horvatin
URS Corp
Angie Shepherd
NPPTL

Abstract

Currently, precise temperature and humidity control requirements are omitted from existing chemical permeation test methods. The ability to effectively control both temperature and humidity would allow permeation test methods to more accurately replicate realistic use scenarios. Chemical permeation test methods are used to evaluate materials used in protective clothing for a variety of applications where there is a potential risk of contact with chemical hazards. Changes in temperature and humidity can directly impact material permeation rates and thus the level of protection from the clothing, garment, or ensemble. As part of a larger NPPTL research project to develop a cumulative chemical permeation test method, a new permeation chamber was designed and built to allow for independent control of both temperature and humidity. In this poster, preliminary data from the new chamber will be presented. If successful, this research will yield a general ASTM test method with a specific procedure for accurately controlling the environmental conditions of the test, which would greatly enhance testing of protective clothing and garments used in sectors such as agriculture, healthcare, and public safety.

PS# 36: Firefighter Equipment Evaluation Program

Authors and Organization: Thomas Pouchot
NIOSH NPPTL

Abstract

This project addresses the Congressionally-mandated NIOSH fire fighter fatalities investigation initiative through participation in firefighter injury/fatality investigations, conducting fire fighter self-contained breathing apparatus (SCBA) field problem investigations, evaluating SCBA performance, evaluating fire department SCBA maintenance programs, and alerting users of technical issues. A unique respirator field problem investigation and assessment laboratory has been established for testing SCBA worn by fire fighters killed or injured in the line of duty. This project provides valuable information on the performance and reliability of NIOSH certified SCBA worn by fire fighters and emergency responders. The information is utilized by NIOSH, the Occupational Safety and Health Administration (OSHA), the Mine Safety and Health Administration (MSHA), and other enforcement agencies to help ensure that the respirators being used are providing a level of protection that meets or exceeds the performance criteria required under 42 CFR Part 84. By assessing the performance of the SCBA being used and through the reduction or elimination of non-conformances, the health and safety of American workers and in particular the over 1 million fire fighters who rely on SCBA for occupational safety, will be improved.

PPT Stakeholders Meeting Mar 29, 2011 (Public Safety Poster Abstracts)

PS# 37: PPE Development at TDA Research

Authors and Organization: Girish Srinivas, Steven Gebhard, Brady Clapsaddle, Robert Copeland, Rita Dubovik, Drew Galloway, Georgia Mason
TDA Research, Inc.

Abstract

With funding from CDC/NIOSH, TDA is developing various technologies that can be used in Personal Protective Equipment (PPE). These technologies can protect first responders, the public, industrial workers, firefighters, etc. from harmful contaminants.

TDA is developing low temperature CO oxidation catalysts that can be used to protect wildland firefighters from the harmful effects of CO poisoning. In addition, our CO catalyst can also be used in CBRN Escape respirators devices.

Our heat exchanger for wildland firefighters is being developed to protect the firefighters' lungs from high temperatures during burn-over situations. The small device can safely cool firefighters' breath from 250F to 100F, protecting them from burning their lungs during burn-over situations. The device needs no expendables, and can function for long periods of time.

We are developing a lightweight cooling system that allows first responders to work in hazmat suits without overheating. The system uses a light weight evaporative cooler and circulates cool, dry air through the hazmat suit.

TDA is also developing a colorimetric end of service life indicator (ESLI) for use in respiratory cartridges. We have built and tested a pre-prototype device that warns the user when it is time to change out the cartridge.

The poster will summarize recent results from each of these projects.

PS# 38: Firefighters' Physiological Responses to Boot Weight and Sole Flexibility during Ladder Climbing and Obstacle Crossing

Authors and Organization: N. Turner, S. Chiou, J. Zwiener, D. Weaver, and W. Haskell
NIOSH

Abstract

Firefighter boots may be composed of rubber, lighter leather, or ultralight fabric. Boot soles can be stitched (less flexible) or cemented (more flexible). The purpose of this study was to determine the effects of fabric/stitched sole (FS), leather/stitched sole (LS), leather/cement sole (LF) and rubber/bonded sole (RF) boots on firefighters' metabolic variables during simulated firefighting tasks. Fourteen women and 14 men, while wearing full turnout clothing, a 10.5-kg backpack, gloves, helmet, and one of four randomly assigned pairs of firefighter boots, walked for five minutes at approximately 0.57 m.sec⁻¹ while stepping over two 15-cm and two 30-cm obstacles and carrying a 9.5-kg hose and then climbed up and down a 3.7-m ladder for five minutes at 25 rungs per minute. Comparisons of boot weight and sole flexibility were made using analysis of covariance with repeated measures. During ladder climbing, boot weight had a significant effect ($p \leq 0.05$) on VO_2/kg in both men and women. There were no significant effects of sole flexibility. During obstacle crossing, boot weight had a significant effect ($p \leq 0.05$) on VE , VO_2 , VO_2/kg and VCO_2 in both men and women. There were significant effects ($p \leq 0.05$) of sole type for VO_2/kg . In conclusion, there were significant effects of boot weight on metabolic and respiratory variables (5- 10% increases per kg increase in boot weight) during both ladder climbing and obstacle crossing, which were mitigated by sole type for VO_2/kg during obstacle crossing.

PS# 39: Field Evaluation of a New Prototype Self-Contained Breathing Apparatus

Authors and Organization: W. Jon Williams, Aitor Coca, Jung-Hyun Kim
NIOSH NPPTL
Richard Duffy
NFPA

Abstract

It is well established that firefighter PPE, including the SCBA, is heavy and cumbersome and imposes an ergonomic “burden” on the wearer. We conducted a field evaluation of a prototype SCBA (MSA, Pittsburgh, PA) consisting of an assembly of 5 compressed air pressure vessels constructed with a special plastic lining in place of conventional aluminum liners, braided with Kevlar®, and wound with pre-impregnated carbon fiber, and pressure rated at 4500 psi. The evaluation consisted of measurements of range of motion (ROM - using a goniometer), timed donning and doffing, and subjective measures of comfort, mobility, and suitability to the task while engaging in firefighter training. The measurements were made while firefighters wore either the prototype (PT) or a standard (STD) SCBA.

There was no difference in the timed donning/doffing or ease of donning/doffing between the STD and the PT despite the fact that the straps and harness design and location on the PT differ from those on the STD and the fact that the subjects were not trained to use the PT prior to the field test. In ROM measurements, shoulder flexion (90%) and trunk extension (40%) was greater in the PT perhaps due to a more even weight distribution and location which improved the stability of the PT. The subjective perception results suggested greater comfort and mobility and less fatigue when subjects performed the assigned exercises while wearing the PT. These findings suggest that the PT does not significantly restrict objectively measured mobility.